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ABSTRACT

The University of Moratuwa (Sri Lanka) developed two courses in English for engineering students, one for technician-level diploma students and one for bachelor's degree-level students. The first step was a needs analysis, conducted through questionnaires and informal meetings with students and faculty, observation of subject lectures and classroom instruction, and examination of the national board certification requirements. It was found that the principal difference in the two groups' needs occurs after the first year of basic physical science and engineering-related subjects. At that time diploma-level students need more vocationally-oriented command of technical English, and the degree-level students need academically-oriented scientific/technological language. A second finding was that diploma-level language needs remain fairly constant while degree-level needs change greatly in the course of the program. Course development proceeded based on the needs assessment, time constraints for the two groups, availability of materials, and development needs. The diploma-level course uses an integrated-skills approach to develop cognitive skills and emphasizes teamwork in a series of progressively more difficult problem-solving situations. The degree-level course is not described here. (MSE)

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# ESP for ENGINEERS: TWO APPROACHES

By

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## I. INTRODUCTION

The English language has played an important role in Sri Lanka as the language of government, administration, commerce and education for almost two hundred years. In more recent times, during the eight-year period from 1948 (the year of independence) to 1956, English was the official language of the country. With this status, it continued to be the language of administration and of commerce, the medium of education in the schools with the highest prestige, and the sole medium of university education. The small but significant minority, probably much less than ten percent, who had the benefit of an English-medium education became an object of envy for the far more numerous vernacular-educated groups because of the striking advantages which English-medium education offered as a path to affluence and to an elevated social status.

With the growing strength of nationalistic feelings after independence, however, it is not

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surprising that in 1956 English lost its position as the official language of the country; it was replaced in that year by the language of the majority population, Sinhala. English also ceased to be a medium of instruction in schools. Sinhala, and the other main language of the country, Tamil, became media of education in all schools and most universities, and English was in future to be taught as a subject in the curriculum. No concomitant step was taken in Sri Lanka, as was done in numerous other post-colonial countries, to compensate for the abandonment of the role of English as an instructional medium by increasing the number of hours allotted to it in the curriculum. As a result, the decline in English standards was precipitous.

This decline had its effects both in the quality of future teachers of English as well as in student proficiency levels in English. While standards of English continued to fall, however, the need for English by a greater proportion of the population began to be felt. This need became even more pressing from about 1977, with the beginning of an upsurge in development and tourist projects in the country. As a result, during the last few years the Ministry of Higher Education has initiated an impressive series of measures designed to raise the standards of teaching and learning English at the tertiary level in Sri Lanka. The purpose of this paper is to illustrate how two such project were conceived, designed and implemented.

The University of Moratuwa, Sri Lanka's only all-technological, English-medium university, existed originally as two separate Institutes of Technology under the Ministry of Higher Education. In 1978, the two Institutes were combined to form a new University. As a result, the University of Moratuwa offers both a technician-level diploma in Engineering(NDT(E), National Diploma in Technology(Engineering)) and a degree course in Engineering(B.Sc.). In 1982, The Asia Foundation funded a project to upgrade the University's English service unit, the English Language Teaching Centre(ELTC). The majority of students who follow the diploma and degree Engineering courses are educated in the vernacular and have studied English as a subject only up to the GCE(O) Level; the NDT(E) and B.Sc. courses are therefore the students' first English-medium course of study, and they often find themselves not proficient enough to study or work effectively in English. As NDT(E) students were also trained during the first year at one additional institution, Hardy Senior Technical College(Ampara) under the Ministry of Higher Education, formal links were established between the University of Moratuwa's English Language Teaching Centre and the ESP Unit of the Ministy of Higher Education. After considerable discussion and preliminary investigation, the University ELTC and the Ministry ESP Unit decided to co-operate in the development of a new first-year course for Engineers. The first step in the process was to undertake a thorough needs analysis of the two target groups of students.

## II. THE NEEDS ANALYSIS

The joint team/course designers used several instruments of both a formal and an informal nature to assess the needs of the target groups. These instruments, primarily questionnaires, were supplemented by a varied programme of meetings and discussions.

### QUESTIONNAIRES

Questionnaires (based upon the work of Dr Cyril Weir, then of the Associated Examining Board, Aldershot) were given to students and teaching staff at both institutions (76 student questionnaires and 42 staff questionnaires). The course designers sat with the students to assist them with the questionnaire so that the data would be as accurate as possible. The team also took care to discuss the questionnaires thoroughly with the subject staff concerned to ensure that they did not view the research as an encroachment on their time and work, or an unnecessary intrusion into their own disciplines.

### OBSERVATION OF SUBJECT LECTURES

In addition to administering the questionnaires, the course designers sat in subject lectures, tutorials and practicals in order to observe real classroom situations. This provided them with valuable information about the level of comprehension required in lectures, the speed of delivery of

lectures, the rhetorical features typically used in Sri Lankan lectures, and the kinds of diagrammatic representations commonly given on the blackboard or in handouts.

## INFORMAL MEETINGS WITH SUBJECT STAFF AND STUDENTS

The course designers also met with NDT(E) and B.Sc. subject staff on an informal basis. These meetings produced valuable discussions regarding basic English language skills lecturers expect of students. Samples of student work were made available. The course designers also met and discussed the two programmes of study with students, both individually and in groups. These meetings were invaluable in that they provided a forum for the subject lecturers and students to provide input into the new course. In addition the meetings established a vital connection between English and subject area staff.

## NATIONAL APPRENTICESHIP BOARD

In their third year, NDT(E) students are required to do in-plant training which is supervised by the National Apprenticeship Board. During this year of on-the-job training, students are expected to maintain daily diaries and to submit periodical reports. The course designers met a number of NAB officers who supervise and monitor the students during this training period. Thanks to their co-operation, opportunities were provided for the course designers to go through field books, notes, diaries, and reports actually made by students, and to discuss NAB requirements.

In interpreting the information gained from these various sources, the joint team looked for general, overall trends in the input data. Only the questionnaire lent itself relatively easily to quantitative analysis. From the whole bank of input data, very clear patterns emerged about both academic and professional student needs.

The clearest dichotomy, as was expected, was the different needs of diploma- and degree-level students after the first year of basic physical science(physics and chemistry) and engineering-related subjects(surveying and technical drawing). The diploma-level students needed a more vocationally-oriented command of technical English, while the degree students' immediate needs were for a more academically-oriented scientific/technological form of the language(see Strevens 1972). Furthermore, it was found that while the needs for diploma-level students during their first two years of study remained fairly constant (oral/aural and basic writing skills), the skills required for degree-level students changed greatly from the first year(oral/aural and basic writing skills) to later years (advanced academic reading and writing skills). These results indicated that two separate English courses would need to be designed.

Numerous constraints had to be taken into consideration in the design of both a diploma-level and a degree-level course however. The most salient of there were:

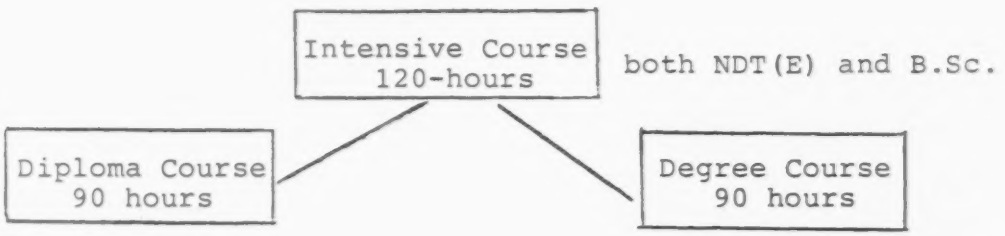
1. both diploma and degree students of both institutions(Moratuwa and Hardy) have a

common pre-sessional 120-hour Intensive Course in English held at the University of Moratuwa. Upon completion of the course one fourth of the diploma students go to Hardy for the first year of study and the remainder stay at Moratuwa. All degree students study at Moratuwa.

2. both diploma-level and degree-level students have an English course of only 90 hours(three hours of instruction per week for 30 weeks) during the first year.

3. both diploma and degree students have no formal English instruction after the first year of study.

The implication of these constraints was that in effect students' language skill needs, both present academic and future academic and vocational, had to be fitted into approximately 200 hours of instruction over a period of one year. Those academic skills needed immediately had to be taught during the Intensive English Course and the first term; skills needed in later years in study or work had to be taught during the latter part of the first year. With this overriding time constraint in mind, it was decided to design two on-going courses which followed from an umbrella Intensive Course:



## III. CRITERIA FOR THE SELECTION OF INSTRUCTIONAL MATERIALS FOR THE TWO COURSES

Once the Needs Analysis was completed and analysed, the choice of instructional materials for both the diploma- and degree-level courses had to be made. For the more academically-oriented degree course, it was ultimately decided to use commercially-available textbooks. There were numerous factors which contributed to this decision:

1. The University project was a one-adviser project. It was therefore impossible for one person to produce materials (or train a team of local university materials writers) and handle all other aspects of the project, such as needs analyses, syllabus design, teacher training, and testing and evaluation.

2. Funds were available from the funding agency to which the adviser was attached for the purchase of multiple copies of textbooks.

3. There were suitable textbooks available on the market for the degree English course. The two books chosen, Basic English for Science, 1978, OUP and English in Physical Science, 1974, OUP, both catered well to the academic needs of first-year Engineering students and were easily adaptable to the skills emphasised in the course. Basic English for Science, an oral approach with some writing, was suitable for the listening comprehension and basic writing components of the Intensive English Course and the first term. English in Physical Science was well suited for the later advanced

reading and writing components. There was no need to re-invent the wheel.

4. Also of concern was the psychological and pedagogical importance of each student having his/her own textbook. Freshers at university level in Sri Lanka do not have individual copies of textbooks in any subject. An English book was therefore unique to them and emphasised the important position of the English class in their curriculum.

The degree-level English course has proven very successful in use during the first two years of the project, and texts have been supplemented where necessary with more communicative exercises and authentic materials. A detailed presentation of the degree course syllabus is beyond the scope of this paper, as both textbooks used in the course are readily available on the market for those interested.

For the NDT(E) diploma course the matter of selecting materials was more problematic. After much consideration, the joint Moratuwa ELTC/Ministry team decided to opt for locally-produced materials for the 90-hour first-year course. This decision was taken for the following reasons:

1. The difficulty of finding suitable published technician-level materials which catered to all the identified needs of the NDT(E) students. The shortcoming of much of the commercially-available material reviewed was that it had been written with a wider target group in mind and was therefore not fully relevant to local needs. This had not been a problem in the selection of the degree course material.
2. The high cost for the Ministry of Higher Education of purchasing imported materials.
3. The belief of the course designers that under favourable circumstances the writing of materials is an integral part

of teacher training. It ensures that teachers will become more involved in the work of the course and will as a result teach the course materials with more understanding and confidence. This is especially important in Sri Lanka where the majority of teachers have a literature background.

4. The belief of the course designers that locally-produced materials incorporating local themes would be of more interest to Sri Lankan students.

5. The course designers were fortunate in having two British VSOs, one Engineer and one Graphic Artist, as part of the materials writing team.

## IV THE DESIGN OF THE NDT(E) COURSE AND ITS OBJECTIVES

On the basis of the results of the needs analysis, a course design was developed for NDT(E)which will be described in detail in the remaining two sections of the paper. In this section the paper focusses on the nature of the course philosophy and the learning objectives of the course, which it is important for both teacher and student alike to be fully aware of.

### COURSE PHILOSOPHY

The NDT(E) course is based upon three main principles. First, it follows an integrated-skills approach, which requires proportionate attention and practice to be given to speaking, reading, listening

and writing in all or most project and activity work. The same skills-based approach also takes account of basic organisational skills. Second, the course seeks to develop cognitive skills in the student, by offering problem-solving tasks that demand reflection, choice, selective analysis and simple decision-making before solutions can be found. Third, course methodology incorporates extensive use of teamwork, in recognition of the importance of this factor in a work context. Thus, no matter how much individual ability may contribute to a given task's successful completion, students have to come together, pool ideas and interact during the stages of problem solving. In accordance with the third principle, it can be expected that student confidence and fluency in using English will increase in the context of team efforts.

The General Aims of the NDT(E) Course are :

1. To encourage and promote oral interaction and communication in English by students when they are participating in experiments of a general, practical kind, leading to an overall awareness of what it means to write a report. Students will be trained not just to do work on their own, but to do this work as part of a team. The concept of a report and its structure will be extended to include simple journal or diary entries, and small projects requiring elementary conclusions and recommendations to be made.

2. To train students in observational, information-

gathering and analytical skills appropriate for technician engineers in the course of practical assignments.

3. To strengthen and encourage students' general knowledge, spirit of enquiry and creativity with inputs from a broad but relevant and interesting range of audio-visual sources.

4. To develop extensive and intensive reading skills through the use of reading comprehension texts to accompany most of the experiment, audio-visual or project based inputs.

5. To encourage purposeful problem-solving activities through data manipulation and discussion in the course of task-based projects.

6. To develop students' confidence in their use of English by regular practice in giving and responding to instructions, asking questions, giving explanations and making a variety of oral statements in report-back sessions. The tasks and experiments are planned as far as possible in a natural, participatory situation in which weaker students need not be nervous, nor abler ones contribute more than their fair share. In carrying out these activities students can draw on subject knowledge as well as English.

7. To develop the students' personal information-storing and locating skills.

8. To help the students develop techniques for producing accurate written English which sets out data and comment in an organised, logical and sequential way as required in the course of technician engineer work on both a routine or a project basis.

## VOCABULARY

Many of the experiments and projects in this course draw upon a wide range of technical words and formulae. These often anticipate that the student will have access to a still wider range, since the topics themselves are selected for their relevance, for example, to fields of Civil, Mechanical or Electrical engineering. No apology is made for this. In some cases glossary suggestions are made, but as much for teacher as student. The point is clear : teachers of ESP are not teachers of Engineering, or whatever subject happens to be their students' discipline. They can dialogue with their students and with the subject teachers and consult their dictionaries concerning specific vocabulary items, but they are probably ill-advised to try to teach them. They could well be wrong. These points will be touched upon again in the following section on the materials themselves.

## COURSE STRUCTURE

The course structure is designed to introduce

student (and teacher) to problem-solving, task-based work attitudes in a gradual manner. Thus, initial tasks are set on simple classroom-based practical experiments, requiring both individual and team approaches. Wider, more demanding topics follow, with local and international settings, though here it should be noted that the 'core' of the course is firmly centred around the topic of Sri Lankan hydro schemes.

A variety of exercises accompanies the course units, ranging from multiple choice questions to tasks which involve role-playing or simulatory activities, with a problem-solving focus wherever possible. Thus, for example, students are asked to think constructively about cost effectiveness for transporting goods and preparing land, studying the data provided; to decide on basic civil, mechanical and electrical engineering questions in given practical situations; and to analyse inter-departmental activity in a simple process of engineering production.

No system of language grading has been adopted for the course. Instead the kind of natural English used in the topic context has been used throughout, and practice done with selected functions, such as predicting, recommending, analysing, introducing, setting out and explaining problems.

## V. THE COURSE MATERIALS

The first stage in writing the course materials

was to consider how best to create situations in which the students would be encouraged to communicate with others while practising certain features of English which they would need during their studies, in-plant training and eventually their job. The materials also had to be flexible enough to cater to the different proficiency levels of the students. The results are a course which requires the students to gather, manipulate and analyse information presented in a variety of forms while working individually, in pairs and groups.

In the selection of the input materials, consideration was given to certain aspects of the students' studies and methods of working in the field of engineering as well as the restrictions on the availability of materials in colleges and likely levels of technical knowledge of lecturers and instructors in English in these institutions.

In the first set of six units, the different aspects of experiment report writing are covered. In the introductory unit the students are first of all made familiar with the general layout of such a report and then given the holistic task of reorganizing a jumbled report. In the following units, students carry out simple experimental surveys requiring a minimal amount of equipment, and then, using graded example reports as models, write their own reports on these surveys.

While working on these units, the students will begin, it is hoped, to develop more confidence in using English when performing and writing up experiments in their main subject areas. This greater confidence can be encouraged if the teacher monitors what the students are doing and saying, and where appropriate directs the attention of the students to errors.

Interest-based materials have been included in the course through the incorporation of film inputs in five of the units. These are supported by modified versions of the film texts and relevant pictures and diagrams. The films are all of short duration, around 20 minutes, and so can be shown twice in a one-hour lesson if desired. Each input is used as a basis for lessons which feature problem-solving mini-projects which students could actually encounter later in the world of work.

Next, in a series of units students follow the steps taken when installing a micro-hydro scheme, including the selection of site, penstock pipe, turbine and generator, as well as looking at the economics of power supply. This project was chosen as it includes aspects of all three engineering fileds being studied by the students (civil, mechanical and electrical). It is also relevant in Sri Lanka as there are about 120 of these schemes in the country, and because of the vast hydro-electric projects now in the final stages of completion. Macro-hydro

projects are also investigated in these units, with similarities to micro-schemes being highlighted.

In most of these units, students are required to solve initial problems using selection criteria based on tables, diagrams, graphs and written information. They are then asked to explain their reasons for making choices. In carrying out these tasks, students are constantly required to communicate with one another in order to complete them satisfactorily.

The last units of the course concentrate on the writing of apprenticeship journal entries. The work in these units is based on a set of descriptions of typical work situations, ones in which the students could quite conceivably find themselves during their in-plant training.

In an English course of this type, ground is covered that is seldom touched upon in other parts of the students' technical education, and which helps to prepare them for work at a professional level. With the inclusion of professionally-related materials in the English course, both students and subject area staff alike are more likely to appreciate the relevance of the English programme. An ESP course of this type also strikes a balance between student needs and student wants: the course content is technical; the course methodology, on the other hand, ensures maximum

speaking practice, which any needs analysis will reveal ranks high among student wants.

But are teachers going to welcome into their classroom materials they might feel to be unintelligible to them because of their technical content? Of course, there is no definitive answer to this question. However, teachers often discover when using the materials that it is not necessary for them to understand every technical word or mathematical calculation. The English teacher here is not a disseminator of technical information. Instead, he or she can concentrate on assisting the students when they have problems expressing their ideas either orally or in writing. This reorientation of classroom activities may take some time for both the students and teacher to get used to, but eventually it should create a more productive teaching/learning environment. The success of such a course naturally depends also on the extent to which the teacher welcomes a task-based, problem-solving approach, and makes determined efforts to implement it, because such an approach necessarily lays more stress on the teacher as manager and monitor than as guru. It is hoped that using this course will help the English language and subject area teacher, at least in part, to feel that their particular interests are both fully considered and welded together.

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